



# Wave JT - LED Chaser with Joule Thief

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## TOOLS:

- [Soldering iron \(1\)](#)
- [Wire cutters \(1\)](#)

## PARTS:

- [Solder \(1\)](#)
- [Wave JT kit \(1\)](#)

## SUMMARY

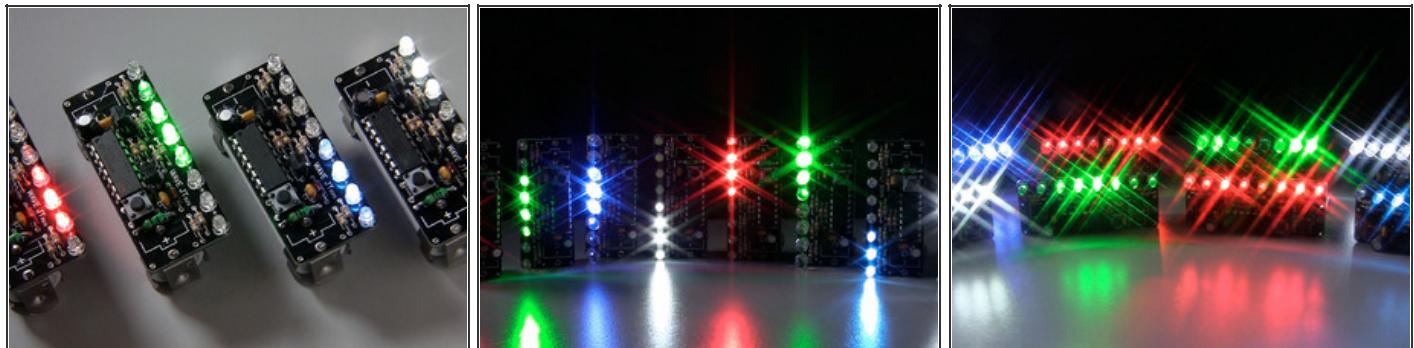
I love LED chasers. A bunch of LEDs neatly turning on and off on a precise timing - lights running one way, then the other way... It's relaxing, soothing, and hypnotic.

There are so many LED chaser/scanner/sequencer circuits out there; some are made with discrete transistors, some based on logic ICs, and more and more others are using microcontrollers.

There is one thing in common with all of the LED chaser circuits you find on the net - none of them can operate with just one alkaline battery!

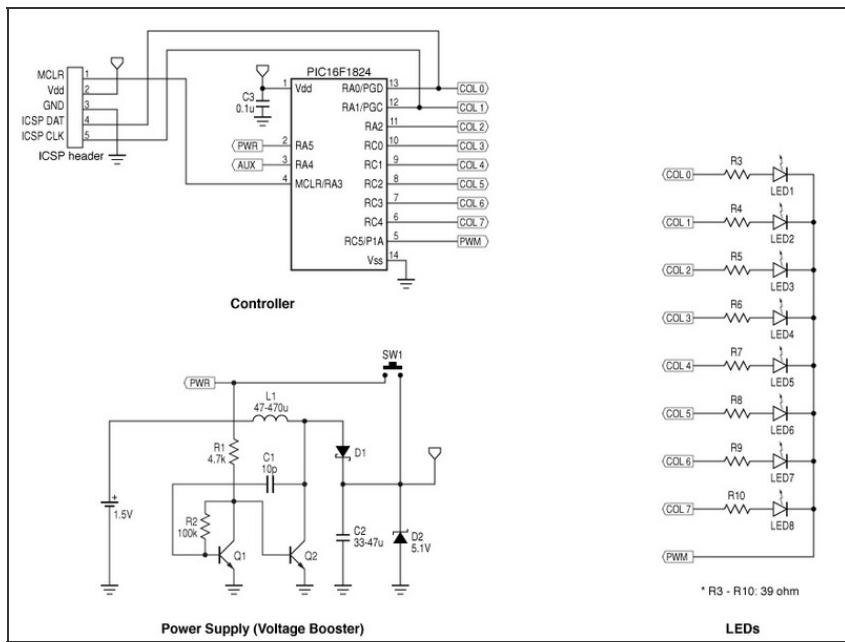
Most of us know that LEDs need at least 2.2V or so to light. Blue and white LEDs require even higher voltage, typically 3.2V. So obviously you can't use just one AA battery to operate an LED chaser. But we all know that there is the Joule Thief that boosts voltage high enough to light any LEDs. Why not use that to operate an LED chaser?

## Step 1 — Features



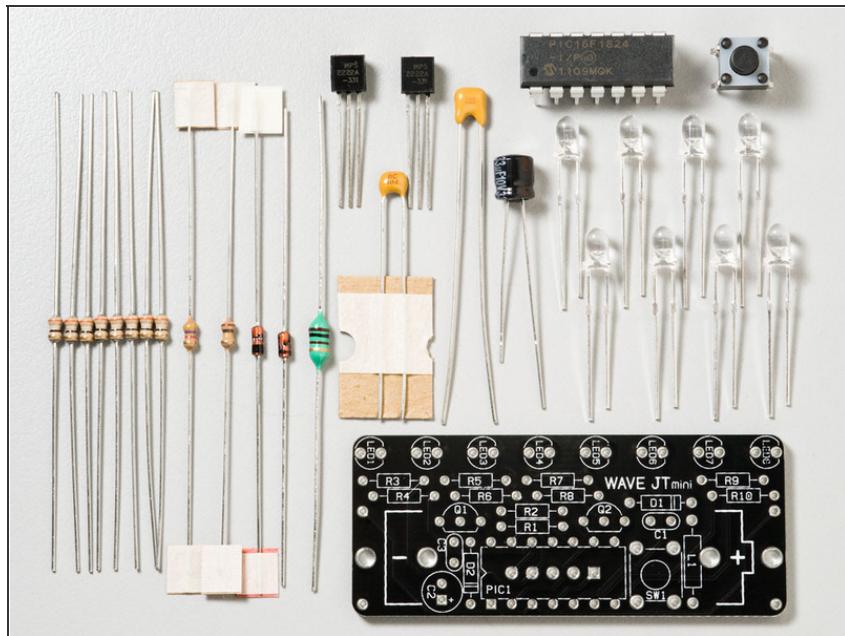
- Wave JT is not only powered by a single AA battery, but it's feature rich.
- Compact & streamlined design.
- Uses only one AA battery (or any 1.5V battery you can hook up to).
- Works well with rechargeables (NiMH or NiCd) too.
- Eight LEDs, each with its own 256 level brightness control.
- Energy efficient - works even with a run-down battery, down to 0.6V (0.8V to startup).

## Step 2 — Circuit Schematics



- The power supply (voltage booster) part of schematic shows somewhat typical Joule Thief circuit, plus a few extra parts.
- D1 (Schottky diode) and C2 form a rectifier to create DC voltage out of the Joule Thief. Zener diode D2 is added to "clamp" or limit the voltage at 5.1V to prevent damaging the microcontroller (maximum voltage this chip can withstand is 6V).
- Without the Zener diode there, the output voltage from the boost circuit can go over 6V when no LEDs are lit.

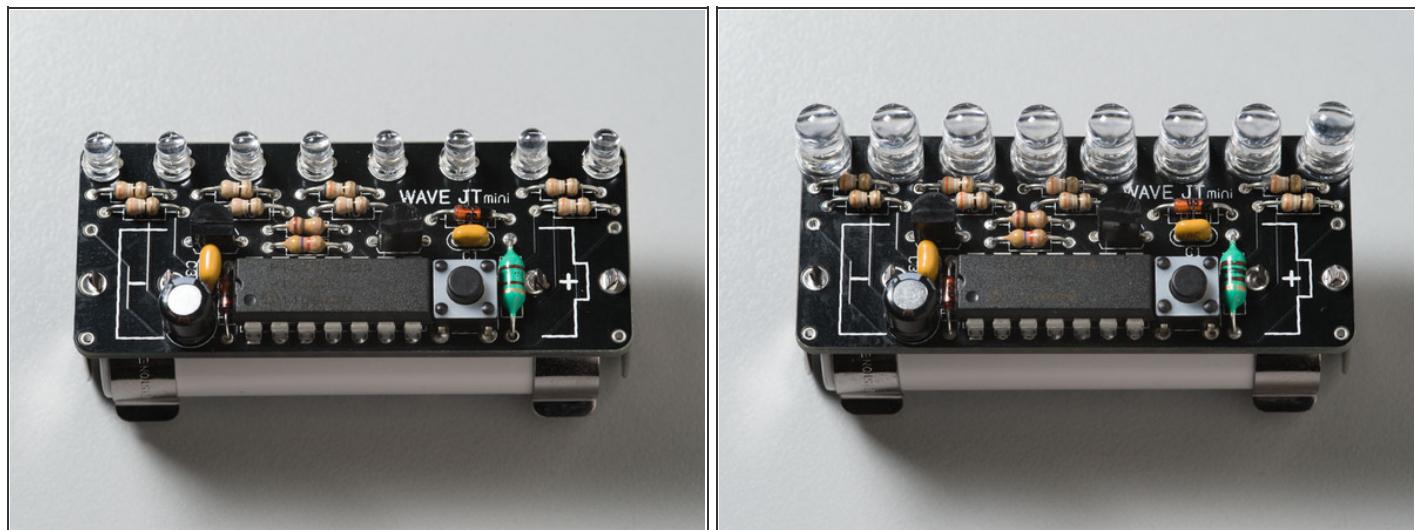
### Step 3 — Parts



- Here are the parts.
- LEDs should be of "super bright" variety. Standard LEDs are not bright enough for this circuit. Either 3mm or 5mm sizes can be used, however the PCB is somewhat optimized with 3mm LEDs. 5mm LEDs hang off the edge of the PCB a slight bit. Make sure to use the same LEDs for all eight of them. (Of course you can experiment mix & matching if you like..)
- Parts list is included in the schematic PDF.

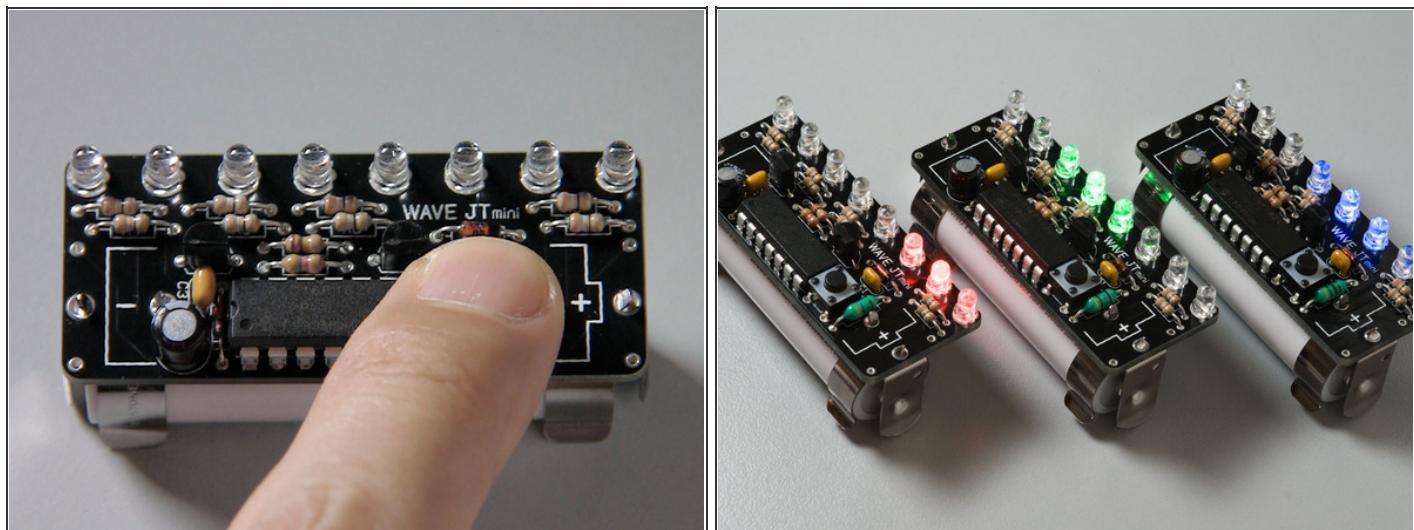


## Step 4 — Assembly



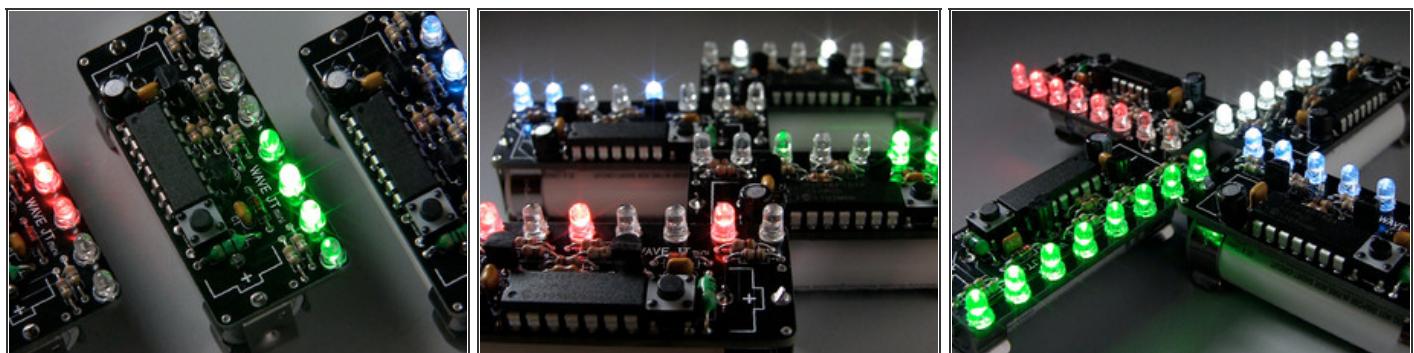
- The assembly is very straightforward. Insert the parts into the PCB, and solder them. Start with lower profile components and move on to larger, taller ones.
- Transistors, diodes, electrolytic capacitor and LEDs have polarities, so make sure to insert them in the correct orientation. Battery holders need a bit of force to snap into the holes. They attach from the back side of PCB as you can see in the picture.
- Once everything is soldered in place, double check the part placement, orientation and solder joints for shorts and bad (cold) connections.

## Step 5 — Programming the Microcontroller (PIC)



- Download the firmware HEX file [here](#).
- Insert 5-pin header to PICKit 2/3 or other PIC programmer, and stick the other end into the back of Wave JT PCB. The 5 holes that you use are marked ICSP, with an arrow pointing to the MCLR pin.
- Set the programmer to supply  $V_{DD}$  of 4.9V and program the PIC.

## Step 6 — Have fun!



- More detailed info available at [Instructables](#) and [The LED Artist](#).

Wave JT is fun!

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